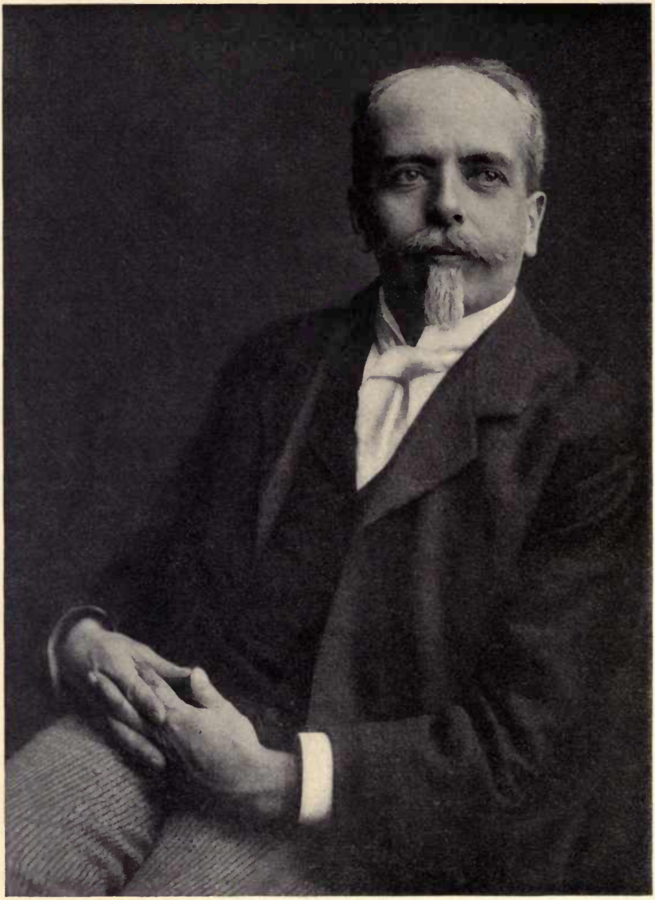
Personal Reminiscences of JAMES MAPES DODGE

BY CHARLES PIEZ.



James M. Dodge

PERSONAL REMINISCENCES

OF

JAMES MAPES DODGE

1916

BY CHARLES PIEZ
President, Link-Belt Company

SYNOPSIS

IN these personal reminiscences Mr. Piez tells of the struggles, early failures and final great successes of one of the most commanding figures in American invention and engineering, and shows us the genial, charming personality of one who did much to shape our present-day industrial ideals. The first part deals with the development of the conveying and coal-storage business and covers a period of Mr. Dodge's life down to about 1900.

In the second part the author reveals the lasting influence of Mr. Dodge in softening and humanizing the Taylor system of management at the time it was installed in the Philadelphia plant of the Link-Belt Company. A number of important inventions in the conveyor and power-transmission field were also brought out after 1900. But important as all these achievements are, his friends will remember Mr. Dodge longest for his magnetic personality, quick sympathy, and never-hesitating helpfulness.

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JAMES MAPES DODGE

By Charles Piez

TWENTY-FIVE years of business association, 25 years of intimate personal relationship, were brought to a close by the untimely death of James Mapes Dodge on December 4, 1915, and these notes are penned while grief is still poignant, while the sense of loss sustained is still acute. Memory has been active in recasting the story of our association, in reviewing the development of a great art, in paying tribute to the genius to whom that development was largely due. For he was a genius, one to whom the accomplishment of today was but an augury of the possibility of tomorrow; a ceaselessly active, dynamic man eternally in quest of progress, yet an easily approachable and thoroughly human man, with deep affections, tender considerateness, and an inexhaustible and never-failing sense of humor.

Mechanical accomplishment, even though its influence reaches into every home, rarely receives wide public mention. The fact

James Mapes Dodge — William Dana Ewart — Thomas S. Fauntleroy that it has been a source of pecuniary profit seems all sufficient in the way of reward. And yet the lessons to be learned from mechanical progress and the examples set by our notable inventors, may have wider public application and deeper public influence than the much heralded attainments of statesmen or the widely recorded works of our men of letters.

It is in the hope that these reminiscences of a man who will occupy an important place in the mechanical inventor's Hall of Fame, will prove of profit to the workers in the mechanical arts, that they are offered in these columns.

In the spring of 1889 an advertisement appeared on the bulletin board of the School of Mines, Columbia College, for two engineering draftsmen, signed by the Link-Belt Engineering Co., of Philadelphia. My application in response to this advertisement was accepted, and I became a member of the Link-Belt organization immediately thereafter. The vice-president and chief engineer of that organization was James Mapes Dodge. He had been connected with William Dana Ewart, the inventor of link-belting, for some years, had assisted him in the design of the detachable chains and their attachments, and, more than any other man, had begun the application of chain to purposes of conveying and elevating material.

This period was followed by several years spent as superintendent of the malleable-iron foundry at which the chains were made, from which position he resigned to conduct some experiments on steel castings in Philadelphia. Upon the conclusion of these experiments, he became associated with Edward H. Burr, who then had the Pennsylvania agency for the Ewart Manufacturing Co. Under the firm name of Burr & Dodge, the application of chain to conveyors and elevators was pushed with such zeal that but for the kindly financial aid of Mr. Burr's father, a receiver would have ended the partners' efforts in the new field. The losses sustained grew out of inexperience, out of the optimism of the enthusiast. Mr. Dodge had invented a new chain known as the Dodge chain, a unique and distinctive improvement on the old cable chain, and he felt he had practically found in it a solution of all conveyor problems. Joseph Cavanagh was in those days the only salesman of the firm, and when Joe came back from the anthracite region with his first order for a Dodge chain conveyor, the firm members came near meeting him with a brass band. If they had so met him and had known what the future held in store for them, they would have had the band play a dirge, for that order was but the first of the series that almost put the firm out of business. The experience was an expensive but nevertheless a very profitable one, for it was a much chastened enthusiasm that met the future problems; and experiments were thereafter conducted at home instead of in the plants of customers.

By 1888 Burr & Dodge and the New York office of the Link-Belt Machinery Co. had prospered to such an extent that a consolidation of the two interests was proposed by Mr. Dodge, and finally effected. The Link-Belt Engineering Co., of Philadelphia, grew out of this consolidation, and this company became the exclusive agent of the Ewart Manufacturing Co. for the Atlantic Coast States, the Link-Belt Machinery Co., organized in Chicago in 1880, retaining the agency for the rest of the country. While Mr. Ewart was president of both the Link-Belt companies, Mr. Dodge was the executive as well as the engineering head of the eastern company. Under his leadership there began an era of invention and development that in the retrospect appears little short of marvelous. Over 120 patents were taken out for him by the firm of Howson & Howson alone, and these patents cover only his later period of inventive activity. His inventions during this later period, beginning in 1884, pertained largely to conveying problems and to transmission chains.

Mr. Dodge and some of his early associates
Office of Burr & Dodge, Philadelphia, Pa.

Several years before I joined the organization he had conceived the idea of storing and reloading anthracite coal by mechanical means. In the preparation of anthracite for the market, all sizes from the largest domestic size to the smallest steam size, are produced. The demand for these sizes varies very materially, the steam sizes being in fairly uniform demand the year through, the domestic demand being active in the fall and winter but very light the rest of the year. To equalize production and to take care of the wide market fluctuations, a considerable portion of the anthracite output must be stored between the mine and the market. Storage of anthracite, when Mr. Dodge entered the field, consisted largely of dumping the cars on trestles and reloading with wheel-barrows. The cost averaged fully 40 cents for the round trip, without taking into account the loss through degradation, which in this method of handling averaged fully 20 cents more.

Mr. Dodge conceived the idea of piling the coal in conical piles and performing both the operation of stocking out and reloading mechanically. His ideas on this subject struck his associates as so bold and radical that they were unwilling to jeopardize the financial integrity of the conveyor business by this bold flight into fields untrodden. But nothing daunted, he proposed that they put up some money for an independent company and permit this company

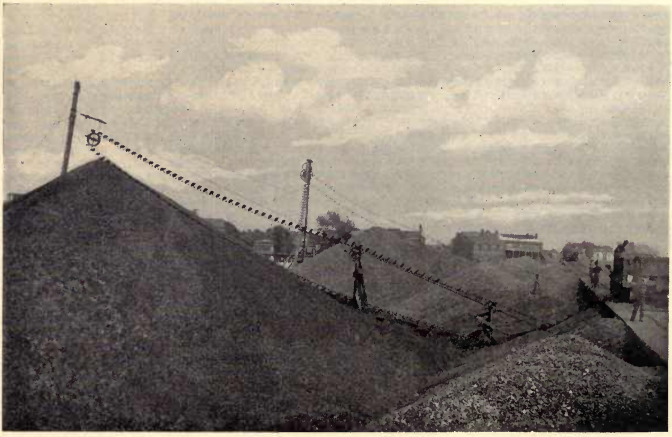


Fig. 1. Original Dodge Coal-Storage Plant of the Reading Ry. at Port Richmond, Philadelphia, Penn.—The Beginning of a Big Business

to install the storage systems. In those days, like most inventors, Mr. Dodge was considerably longer on ideas than he was on cash, and he was therefore under the constant necessity of inducing his moneyed associates to furnish the funds. Fortunately for both his associates and himself he was a magnetic and convincing talker and finally won a rather reluctant consent to his proposition. Ten thousand dollars was put up in cash, and a company known as the Dodge Conveyor Co. was organized. It contracted to store and handle a certain yearly tonnage for the Philadelphia & Reading Ry. at Port Richmond. In spite of limited means, inexperience, and the crudest of crude machinery, his ideas proved sound and the contract financially remunerative. A second contract was thereupon secured from the Pennsylvania R. R. at South Amboy, in which an actual sale of the machinery was made to the railroad company. The soundness of the idea met with such prompt acceptance that further contracts for two plants were secured from the Delaware & Hudson company.

One of these covered a storage plant of 150,000 tons' capacity, to be located on a narrow island in the Hudson River at Rondout, N. Y. The system of storing as it had been developed at that time is illustrated in Figs. 1 and 2, and consisted of a mast and boom which carried the stocking-out conveyor head machinery. The

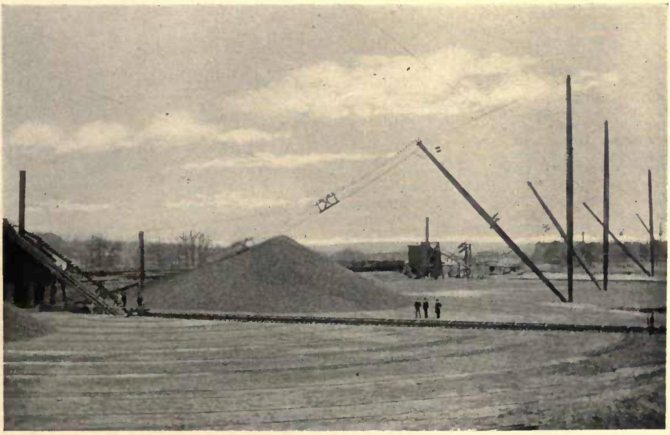


Fig. 2. Improved Mast-and-Boom Plant of the Pennsylvania R. R. at South Amboy, N. J.

mast had to be securely anchored to guy ropes, which of necessity had to lead away from the coal pile. At Rondout, Mr. Dodge almost met his Waterloo, for after the company had been awarded the contract he found the island just wide enough to hold the coal piles, and to use his own expressive phrase, "There wasn't a darn thing to anchor the guy ropes to except the swift current of the Hudson River."

But the difficulty was met in a very ingenious fashion, for right on the spot he developed the idea of spanning the piles with light hinged trusses and securing them against side wind pressure by anchor and guy ropes. This put the guy ropes lengthwise of the island, where there was plenty of terra firma for anchorage. The change, while adding considerably to the cost, added materially to the effectiveness of the storage system, for it afforded him the opportunity for the invention of the ribbon-bottom conveyor, which aided so materially in reducing the breakage of coal.

Compare the two cuts, and the tremendous step ahead attained by the invention of the shear-truss construction will be apparent at a glance.

The unsuitability of Hudson River water to serve as an anchorage for the mast and boom construction had developed the idea that was

Fig. 3. Shear-Truss Construction Invented as a result of the Rondout experience; Susquehanna Coal Co.'s Plant at Old Bridge, N. J.

needed to round out and perfect the system. It became the recognized method of storing anthracite coal in large quantities and has remained so. See Fig. 3.

Mr. Dodge's invention was absolutely generic, and he was entitled to the broadest kind of patent protection; but a poorly drawn set of claims opened the doors to a competitor, who sold one plant. The patent office, recognizing the merits of Mr. Dodge's invention, granted his application for a re-issue, and the amended process claim was so carefully and yet so simply drawn that we were never again subjected to infringement.

Those days in the late eighties and the early nineties were active, interesting days. The conveying art was so young that few standards had been developed, and a broad field for invention lay open before us. The shops worked in a happy though leisurely fashion, but the margins of profits were large and there was no immediate incentive for systematized intensification of production. In 1889 when the plant at Nicetown, Philadelphia, was built, Louis Wright was appointed superintentent. He was a capable man who had served serveral years of apprenticeship under Frederick W. Taylor, who was then at the Midvale Steel Works. Mr. Wright gradually brought about some semblance of orderly procedure in the manufacturing departments, though it was done only after a lot of argument and after the exercise of some pressure. For Mr. Dodge worked on impulse and looked upon any systematic procedure that harnessed or directed impulse as an unnecessary and unwise restriction of initiative. When Louis Wright argued that the execution of a customer's order should take precedence over the carrying on of an experiment, Mr. Dodge very reluctantly assented; but when Louis Wright argued for a further extension of system and records, Mr. Dodge said: "Louis, in the several years that you have been here, the only decision of any importance that you unearthed out of this mass of records was that when you wanted to paint a fence it was cheaper to use dressed lumber than rough lumber. I could have guessed that if you had asked me." His contempt for records in those days is particularly interesting because fifteen years later he became recognized as the most ardent advocate of the Taylor system.

His attitude toward college men underwent a similar change. Though a college man himself, his quick mind grasped mechanical and mathematical facts without the necessity of demonstration. He looked upon many of the mathematical propositions as self-evident and rebelled at the idea of being compelled to prove axioms. The whole college curriculum struck him as a perhaps necessary program for dullards, but as unnecessarily restrictive to the student of wide mental grasp and quick perception. In his own experience he felt that his work in the shop had been of tremendously greater help to him than his work at college, and he was apt to minimize in those early days the practical value of technical training.

Yet in his annual address on the "Money Value of Technical Training," delivered in 1903, while president of the American Society of Mechanical Engineers, he states, "The progress of the world, however, calls for a better and more speedy means of producing trained men than can ever be developed by the methods of self-instruction," and the chart accompanying the address — developed as the result of exhaustive analysis — shows the high esteem to which the graduates of technical schools had risen.

Our work had gradually taken on an engineering as well as a mechanical aspect, and the rapidly expanding engineering department gave him an excellent opportunity to compare the technically trained with the self-trained men. He realized upon investigation that while some technically trained men were absolutely lacking in mechanical instincts, and while more perhaps were wholly lacking in commercial sense, yet on the whole the percentage of capable and successful men developed out of our collegiate employees largely exceeded those developed out of the self-trained class.

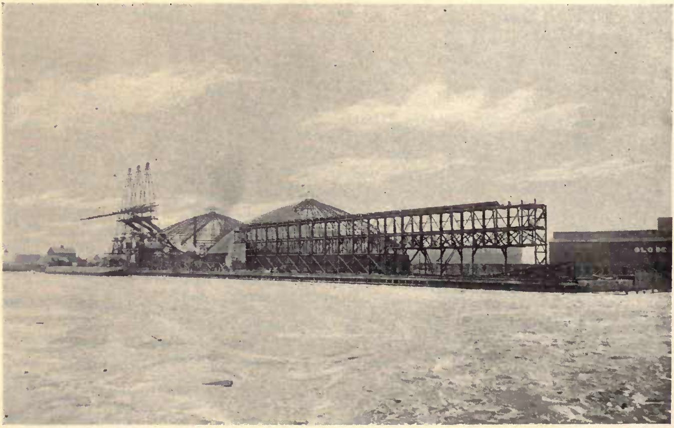


Fig. 4. Circular Storage Buildings of the Lehigh Valley Plant

A UNIQUE BUT VERY SIMPLE ENGINEERING INVENTION

During 1893 and the succeeding years our business gradually declined in volume as a result of the general depression following the Baring failure, and we were compelled in order to keep the plant going to take on several large contracts that were more hazardous than they were remunerative. The most conspicuous of these contracts was that taken from the Lehigh Valley Coal Co. for its coal dock at West Superior. We were called in at the very last minute and given an opportunity to bid. The problem submitted consisted in storing 50,000 tons of stove and 50,000 tons of nut anthracite coal under cover, and 40,000 tons of bituminous coal in the open, the coal to be taken from vessels and delivered from storage into cars. The Lehigh Valley had practically decided to adopt a plan consisting of wooden sheds into which the coal was to be distributed by means of a cable railway. Mr. Dodge, under the stress of this seemingly insurmountable competition, developed his covered storage system, convinced the Lehigh Valley of its value, and secured the contract for upward of $260,000, in spite of the fact that the plan was wholly untried. The plant brought with it a train of engineering and mechanical problems, all of which were successfully met, but the particular idea which made it possible to secure the contract was a unique but very simple engineering invention.

The plan submitted by Mr. Dodge included the use of two circular buildings, 246 ft. in diameter, 90 ft. high, with vertical retaining walls 17 ft. high (see Fig. 4). Now the pressure exerted by anthracite coal is about one-third of water pressure when the coal is level with the top of the wall, and fully one-half of water pressure when the wall is surcharged, and the structure necessary to take care of this pressure loomed up as one involving prohibitive expense. Imagine a boiler 246 ft. in diameter with a pressure of 510 lbs. per sq. ft., and you will get some idea of the structural problem involved. But Mr. Dodge decided to make the coal sustain the wall, and while it seems paradoxical to say that the material that causes the pressure can be made to sustain that pressure, yet that is exactly what his scheme contemplated. The illustration, Fig. 5, shows a section of the building and illustrates the use of the anchor band which solved the problem in very simple and economic fashion. The band is circular and is suspended about 30 ft. inside of the retaining walls.

In the operation of stocking out coal a section of the band is covered before any pressure is exerted by the coal against the corresponding section of the wall, and the necessary anchorage to the band is readily secured by light rods.

The retaining walls were constructed of 8-in. I-beams and No. 10 corrugated metal, the anchor band of $\frac{5}{16}$-inch steel 3 ft. wide, but this simple and cheap construction has stood up without flinching for 20 years.

In the midst of his activities in development and invention Mr. Dodge never failed to pay attention to the human side of the industrial problem. His sunny optimism, his personal interest in every employee, and the ease with which he could be approached on personal or business grounds made him a prime favorite among the men. His office door was always open to any employee, no matter how lowly, and tales of unfairness whether of rates or treatment received earnest attention and resulted in prompt and corrective action. His invariable injunction to his aids concerning the treatment of workmen was, "In case of doubt decide against the

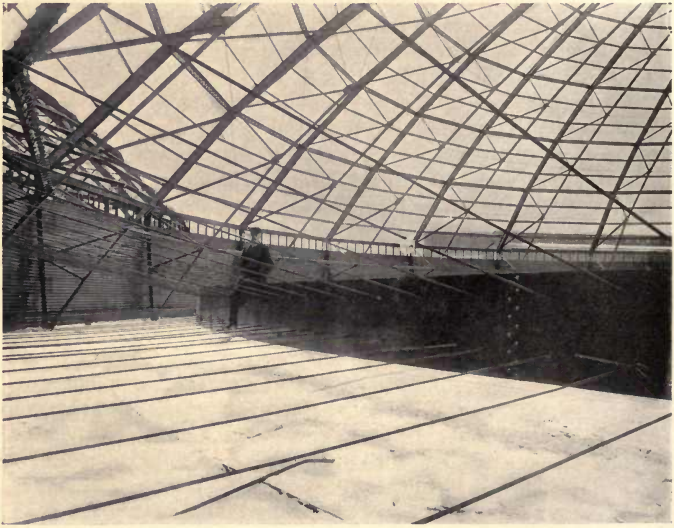


Fig. 5. Circular Anchor Band to which the outer wall is secured

company and in favor of the man." Men brought to him stories of their personal troubles, and he always lent a helping hand to tide them over a difficulty. Under such evenhanded and considerate treatment no threat of strike ever appeared on the horizon of our Philadelphia plant, and even the radical changes involved in the installation of the Taylor system were met with tolerance and co-operation. Mr. Dodge described his relationship with his men in unusually happy fashion when, in answer to the question, "What is your relation with your men?" put to him by a member of the Federal Commission on Industrial Relations, he said, "Well, I don't know exactly, but I think most of them are more inclined to call me Jim than they are Mr. Dodge." "Training men into our methods and habits costs money, so don't fire a man unless you have a good reason, and not then until after you have talked it over with the superintendent," was his constant admonition to those in charge of employees.

He was equally sane on the treatment of customers. "We are prepared at any time to send out a salesman at an expense of a hundred dollars or more to secure a customer, and our accounting department will break with him over a difference of 40 cents." "If we allowed every demand that was made by our customers without question, we would save time, create good will, and be money ahead in the end," were some of his business maxims.

His directness of method was well illustrated in his treatment of our Philadelphia purchasing department. This department, while under able management, had so buried itself under a mass of records that an investigation was ordered. The examination revealed that the large purchases were all made on yearly contracts and that, eliminating these, the cost of purchasing the remainder ran about 15 percent. Soon after, during one of our morning conferences, he said, addressing our buyer, "Ed, do you believe in the honesty of the average man?" "Of course," replied Ed. "Well, suppose we distribute our orders each morning without asking for price, would we have to pay 15 percent more than we pay now?" "No," said Ed, "I believe most of the sellers, in their desire to retain our business, would sell much closer to the market than that." "Then we can save money by abandoning our purchasing department," said Mr. Dodge, and with a few additional words of enlightenment Ed decided to return to simpler methods.

MR. DODGE'S INTEREST IN TAYLOR-WHITE STEEL

It was but natural that Mr. Dodge, with his strong leaning toward the new and untried, should evince intense interest in so epochal an event in the mechanical world as the discovery of Taylor-White tool steel. From the very first he was an ardent champion of its possibilities and was eager to give it a trial in our Nicetown plant. We secured shop rights for its use at both Chicago and Philadelphia and immediately proceeded to test its possibilities when applied to the machining of cast iron. Mr. Taylor's own experiments had up to that time been confined largely to the turning of steel, and it was at our Nicetown plant that the feed and speed possibilities of Taylor-White tool steel applied to cast iron were first determined. Under the infection of Mr. Dodge's enthusiasm our entire organization suffered for a time from a mild form of speed mania, and officials and machinists vied with each other to establish new records in the amount of metal removed per hour. Our line-shaft speeds were doubled, our power plant had to be materially enlarged, and as a final step to secure the desired flexibility in both power and speed, the line-shafts were abandoned and individual motor drives introduced in their place.

For a year or more the orderly procedure of our machine shop was seriously disarranged by the attempt to drive the machine tools to the limit of the tool-steel capacity. The output was increased, but breakdowns were so frequent that the increase in expenses more than outweighed the advantage of added output. It was then that Mr. Dodge realized that the burden of changing equipment and methods to meet the possibilities of the new tool steel, was too severe to impose on an organization already fully absorbed in looking after the needs of the company's regular business. He consulted Mr. Taylor about our predicament, and Mr. Taylor suggested that we employ Carl Barth, one of his aids, to assume charge of the changes brought about by the use of the Taylor-White tool steel. Mr. Barth had had considerable experience in the machining of steel, but realizing that we were suffering from the lack of accurate data on the speeds and feeds possible on cast iron, he at once inaugurated an exhaustive series of tests. While these were being carried on, saner cutting speeds were advocated, the toolroom was thoroughly reorganized and machine tools rearranged and rebuilt. Under Mr. Barth's intelligent direction both equipment and men were well prepared before the first actual step of producing work at high speed was undertaken. And his work was thoroughly done, for once begun, the work of changing over to the new feeds and speeds proceeded rapidly.

While this work was going on, Mr. Dodge became much enamored of the Taylor system, which had but shortly before been outlined in Mr. Taylor's famous paper presented before the American Society of Mechanical Engineers. At Mr. Dodge's request Mr. Taylor agreed to assume general direction of the introduction of the system, and Mr. Barth was retained to undertake the actual work.

While the work Mr. Barth began with proceeded rapidly and very satisfactorily, and while the actual reorganization of tool-room and machine-shop equipment, the installation of functional foremanship, and the establishment of rates based on unit time study and supported by instruction cards, were accomplished in remarkably good time and with less embarrassment than was thought possible, the rest of the work gave considerable trouble, before a perfect scheme of routing and of coordination of the various functions and departments was established. Much of our trouble arose from the facts that the attempt was made to fit the business to the system, and that insufficient advantage was taken of methods which years of experience in our peculiar line had developed. Rigidity in any system is a serious if not a fatal disadvantage, and this truth was as much inpressed on Mr. Taylor as on the rest of us before the work was completed, for it was only after we made certain departures from the rigid formula of the system, that difficulties began to disappear and progress became rapid. It must be remembered that ours was the first plant of any size that was thoroughly systematized on Taylor lines, and difficulties were therefore to be expected. We had all labored under the impression that the system was a complete entity that required but a thorough understanding to work miracles. We were all inclined to stand aside and let it work, until we found that, after all, it accomplished nothing of itself, that it merely indicated the easiest lines along which work could be accomplished.

Mr. Dodge's contribution to Mr. Taylor's work, while not reflected in any of the forms or details of the system, was nevertheless an important one, for his influence lay wholly on the side of recognizing the human side of the management problem. Mr. Taylor's mind was essentially analytical and mathematical. He was inclined to consider workmen as wholly impersonal beings, and to disregard the effect of prejudice and sentiment on output. His tendency originally was to concentrate all direction and initiative in the planning room, and to insist that the men follow the strict letter of their instructions. It was due largely if not wholly to Mr. Dodge's influence with Mr. Taylor that the Taylor system lost its seeming asperities and harshness. And this was brought about not by any distinct modifications in the system itself, but rather by cultivating

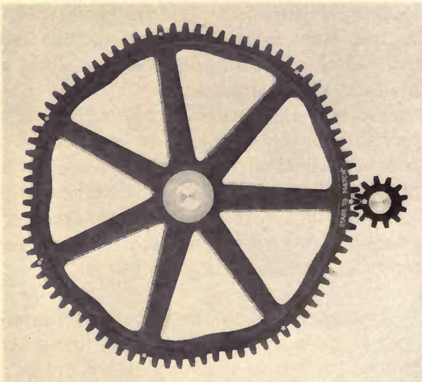


Fig. 7. Lobular Gear and Elliptical Pinion of Equalizing Mechanism

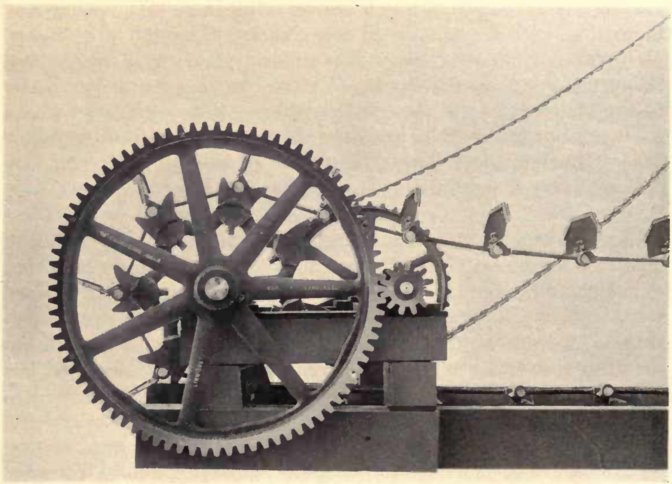


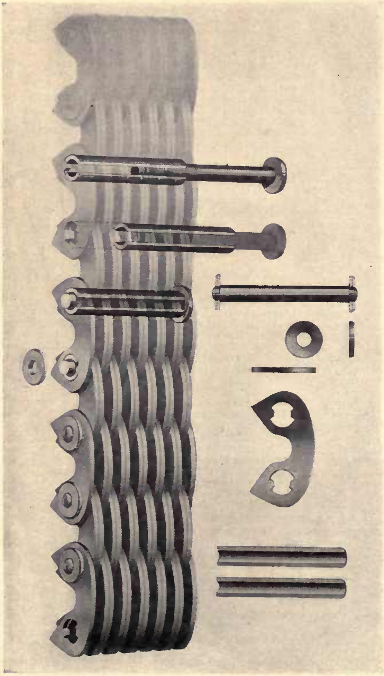
Fig. 6. Equalizing Gear for Long Pitch Conveyor Chain extensively used

in the men who applied the system, an appreciation of the human factor in scientific management. For after all there is nothing inherent in the Taylor system that marks it as an especially attractive instrument in the unwholesome process of grinding blood money out of the workers. Like every other method or system of industrial organization, it can be used to the disadvantage of the men, but that abuse lies in the application and not in the system itself. As a matter of fact the greater preparation which a management must undergo to install the system, the greater accuracy with which the various steps must be taken, and the greater dependability of its records, all make for greater honesty and a broader and more liberal attitude in its application. Certain it is that in our own plants the system has proved highly satisfactory. That it has worked no hardship on our workmen is attested by the fact that although a very active campaign has been waged in Philadelphia to secure machinists and tool makers for several new munitions plants, and although high wages and exceptionally liberal bonuses have been offered, not a single machinist or tool maker has been lured away from our Philadelphia plant.

But interested as Mr. Dodge was in the installation of the Taylor system, his active mind could not find entertainment in the slow and tedious process of teaching an old organization new habits; and so he reverted constantly to the realm of invention and improvement. During the development of our conveyor business we had shown an increasing tendency toward the use of chains of a pitch of 18 in. and more. These chains were adopted both because they were cheaper, and because, in such cases as bucket carriers, they lent themselves better to the purposes of the conveyor structure. One serious drawback to the use of these chains arose from the fact that wheels of relatively small diameter, which had to be used to economize head room, imparted a very irregular motion, or surge, to the conveyor.

A popular size of wheel for an 18-in. pitch chain is 41 in. in diameter and has 7 teeth. By looking at Fig. 6, it will be seen that as the link enters engagement with the sprocket, it is carried forward along that part of the arc that has a large horizontal and a very small vertical component. As the wheel revolves, it carries the link up the ascending arc, where the horizontal component lessens and the vertical component increases. If the link in engagement is considered as a connecting-rod between the revolving sprocket and the remainder of the conveyor chain, the analogy between its operation and that of an engine connecting-rod becomes apparent. The only difference is that the chain link is carried through an arc of about 51½ deg. when the next link engages, while the connecting-rod head describes the full arc of 360 deg. But in spite of the small arc passed through, there is a decided acceleration and retardation during the engagement of each chain link. In a conveyor employing 18-in. pitch chain and running at 120 ft. per minute these pulsations occur 80 times per minute; and when the conveyor is long, they become greatly magnified by the elasticity of the chain. The resulting surging of the conveyor is decidedly destructive to the integrity of the conveyor mechanism, besides being unsightly in appearance.

Mr. Dodge solved this problem in characteristically simple fashion by imparting pulsations to the rotating conveyor shaft which completely counteracted the pulsations in the conveyor.



Figs. 8 to 12. Steps in the development of Mr. Dodge's Bushed Silent Chain

Fig. 8. Ghost view of Mr. Dodge's Pin-Bushed-Joint Silent Chain

This was accomplished by using between the head and the countershaft a set of gears, of which the pinion was elliptical and the gear lobular, the number of gear lobes corresponding to the number of teeth in the conveyor sprocket, see Fig. 7. The gears imparted the desired corrective action to the shaft, and the conveyor chain at once assumed habits of regularity. Equalizing gears, as we call these compensating gears, have been almost universally adopted for driving long-pitch chain conveyors.

In spite of the great varieties of chain which we manufactured, and in spite of the very considerable contributions which Mr. Dodge's inventive genius had made to this part of the work, he remained under the impression that the universal chain had not yet

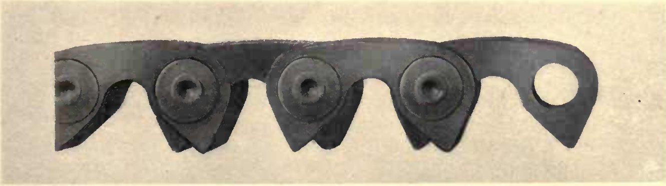


Fig. 9

Fig. 11

Fig. 10

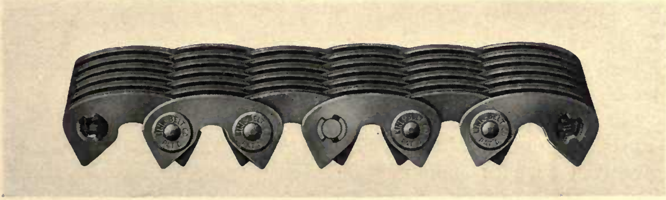


Fig. 12

Figs. 9 and 11. English type using plain link and pin. Figs. 10 and 12. Elements of Dodge type of Bushed Silent Chain

been developed. He had a theory that if you kept yourself in a receptive mental condition, some thought wave carrying the solution of the problem confronting you, would strike a sympathetic chord in your mind, and he had a habit of sensitizing his mind to possible impressions.

Some time in 1899 he conceived the idea of the silent chain — that peculiar form of link which greatly reduced the noise of engagement with the sprocket. When he got to the patent office, however, he found that Hans Renold, of Manchester, England, had anticipated him. So highly did Mr. Dodge value the opportunities that this type of chain offered, that I was immediately dispatched to England to secure the American rights from Mr. Renold. This was done in 1900, and in the following year we placed upon this market the first American-made Renold Silent Chain. Our business in this new line developed rapidly — more rapidly at first than our experience warranted — but we learned rapidly, and with Mr. Renold's experience to draw on, avoided many of the pitfalls that usually beset new ventures. But we were unwilling to proceed as cautiously in the application of the chain as Mr. Renold was proceeding, and with the daring that is characteristic of American business we soon launched into the field of large power transmissions.

The inherent weakness of the original English type of chain rapidly developed in these larger installations, for pins began to cut and the holes in the links to enlarge. We tried high-carbon steel links, and then turned to casehardening both links and pins; but these proved but partial remedies. Mr. Renold, who had in the meantime encountered the same difficulty, tried to increase durability by forcing casehardened steel thimbles into the eyes of the links. But it was not until Mr. Dodge invented the bushed silent chain that this new medium of power transmission achieved general and successful application. Instead of adhering to circular bushings, Mr. Dodge employed through bushings, or liners, as an examination of Figs. 8 to 12 will reveal, and by this means succeeded in giving to each set of opposing links a bearing extending across the full width of the chain — a unique and heretofore unheard-of result in the cylindrical bearing of a multi-leaf chain. With both pins and bushings hardened, and with avenues of lubrication opened up by the peculiar construction of the joint, the difficulties standing in the way of the rapid expansion of the silent-chain business were cleared away, and Mr. Dodge had achieved another conquest of the impossible.

As an evidence of the versatility of his genius it is interesting to recall that in 1873 he secured a patent on a chain-oiling street-car axle bearing, perhaps the very first self-oiling bearing employing a chain to lift and distribute the lubricant. The folding theater seat, in which the back assumes a vertical position when the seat is folded up, and the wire hat-rack so universally used under the seats of theater chairs, are both contributions of Mr. Dodge to the convenience of the public.

But his friends will longest remember his singularly magnetic personality, his quick sympathy, his never hesitating helpfulness; and they will remember too his buoyant good-fellowship, his unfailing wit and his unusual ability as a raconteur. His conception of duty to his family, to his employees and associates, and to the public, was a broad and generous one, and he strived conscientiously to discharge it. His life was therefore a full one, and measured by accomplishment, by public and personal duties well performed, a highly successful one.

Mr. Dodge telling one of his stories
Reading from left to right: Edward H. Burr, Bronson B. Tuttle, Thomas S. Fauntleroy, Edward A. Turner, Alfred A. Pope, John H. Whittemore, James M. Dodge, William D. Ewart, S. Howard Smith

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